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**An Assessment of Hepatitis B0 Vaccine Coverage
in Kerala**

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Foreword

The prevalence of Hepatitis B among general population in India is 2-10 percent, which places India in an intermediate endemic zone and second largest global pool of chronic hepatitis B infection. To protect people against the disease Hepatitis vaccination has been made an integral part of national immunization schedule worldwide since 2008 as per WHO recommendations and has become routine vaccination of all infants against HBV infection. The hepatitis B vaccination schedule in UIP includes Birth dose within 24 hour of delivery, followed by three more doses of Hepatitis B vaccine. Infants and children are particularly vulnerable for chronic infections. Children contract the disease from their mother at birth or simply from another child while playing. The present study focuses on the coverage of Hepatitis B0 in the State of Kerala and its districts using HMIS portal data. Knowledge about Hepatitis B0 vaccine, ideal practices and safe storage of Hepatitis B0 vaccine among health staff and Pediatricians in selected Govt. district hospitals and private hospitals in Kerala are analysed.

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I appreciate the authors of the study Dr. Shylaja L, Research Officer, Dr. Anitha Kumari K R and Dr. Rajesh J Nair, Field Investigators in successfully completing the study. The findings will definitely be of great use to Planners and Policy makers.

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Executive Summary

Hepatitis B caused by infection with hepatitis B virus is a severe global health burden. Hepatitis B is a public health problem affecting about 10 percent of the world population. In India, the prevalence of Hepatitis B in general population is 2-10 percent, which place India in an intermediate endemic zone and second largest global pool of chronic Hepatitis B infection. Govt. of India has incorporated the vaccine in the Universal Immunization programme (UPI). The Hepatitis B vaccination schedule in UIP includes Birth dose within 24 hour of delivery, followed by three more doses of Hepatitis B vaccine. The present study focuses on the coverage of Hepatitis B0 in the State of Kerala and its districts using HMIS portal data. For assessing the coverage of the vaccine monthly uploaded data for the period of April 2017 to February 2019 has been incorporated. Though the coverage of other vaccines hover around 100 percentage in the State, that of Hepatitis B0 was below 65 percentage. Among the districts, Pathanamthitta and Kottayam have recorded better coverage while the coverage of Malappuram, Kasaragod, Kannur and Thiruvananthapuram recorded poor coverage of the vaccine. The likelihood of gap in the coverage suggest introduction of special programmes in the poor performing districts to improve the coverage. The HMIS data analysis also suggests the need of proper quality checking in the uploaded data by the authorities.

The awareness and practice of administration of vaccine by health providers in the selected delivery points in the State has been assessed through qualitative manner. Finding reveals that some of the health facilities have not provided the birth dose of Hepatitis B due to shortage of vaccine and steps have not been taken to initiate local purchase also. Regarding awareness, low birth weight of the newborn is still considered as a contraindication regardless of new guidelines. Training regarding introduction of new immunization programmes and guidelines need to be strengthened in the State. Medical officers and Staff Nurses in the private hospitals should be included in these programmes.

1. Introduction

The Global Burden of Disease (GBD) project developed estimations of the real burden of mortality from viral hepatitis from the beginning of 2000s. It then became clear that cirrhosis and hepatocellular carcinoma accounted for the majority of the burden from viral hepatitis (Perz, et al., 2006). Prevention interventions progressed further, with initiatives on blood safety (WHO, 2005), health-care injection safety infection control, and reduction for people who inject drugs (Hutin and Chen, 1999). In 2010, the World Health Assembly adopted the first resolution on viral hepatitis (WHO 2010) which led to the establishment of WHO's Global Hepatitis Programme in 2011. A second resolution in 2014 (World Health Organization; 2014) further underlined the public health importance of viral hepatitis, and raised the possibility of elimination of HBV and HCV.

The global response to viral hepatitis entered a new phase in 2015, when the UN General Assembly adopted the 2030 Agenda for Sustainable Development, which called on the international community to combat hepatitis. The following year, the World Health Assembly adopted WHO's first "Global Health Sector Strategy on viral hepatitis", with elimination as its prime vision. Many countries have achieved outstanding coverage with the Hepatitis B vaccine, scoring an early win for prevention. The recent development of highly effective direct-acting antivirals, with cure rates exceeding 95 percent, has revolutionized the treatment of chronic Hepatitis C infections. Most countries have also made good progress in keeping blood supply safe and improving injection safety in health-care settings, substantially reducing the risk of both Hepatitis B and C virus infections.

1.1 Magnitude of HBV Infection

However, a large number of people – about 325 million worldwide in 2015 – are carriers of Hepatitis B or C virus infections, which can remain asymptomatic for decades. Viral hepatitis caused 1.34 million deaths in 2015, a number comparable to deaths caused by tuberculosis and higher than those caused by HIV. However, the

number of deaths due to viral hepatitis is increasing over time, while mortality caused by tuberculosis and HIV is declining. Most viral hepatitis deaths in 2015 were due to chronic liver disease (720 000 deaths due to cirrhosis) and primary liver cancer (470 000 deaths due to hepatocellular carcinoma). Globally, in 2015, an estimated 257 million people were living with chronic HBV infection, and 71 million people with chronic HCV infection. As per WHO 2016 report, chronic Hepatitis B infection occurs in about 350 million people with more than 6 lakh deaths each year and about 3 percent of the world population has been infected with HCV worldwide with more than 170 million chronic carriers and 3.5 lakh deaths every year. Access to affordable hepatitis testing is limited. Few people with viral hepatitis have been diagnosed (9 percent of HBV-infected persons, 22 million) worldwide. Among those diagnosed, treatment has reached only a small fraction. In 2015, 8 percent of those diagnosed with HBV infection or 1.7 million persons were on treatment (WHO, 2015).

India has intermediate endemicity for hepatitis B virus (HBV) with about 4 percentage individuals being chronic carriers of the virus. HBV is the leading known cause of chronic hepatitis, cirrhosis and hepatocellular carcinoma. Infection with HBV may be acquired by the perinatal route (vertical transmission), during childhood close contact with infected family members (horizontal transmission) through transfusions or use of infected needles and by sexual contact. Infection at younger age is associated with higher risk of chronic carriage and chronic liver disease. The number of HBsAg carriers in India has been estimated to be over 4 crore (40 million). About 15-25 percent of HBsAg carriers is likely to suffer from cirrhosis and liver cancer and may die prematurely. Infections occurring during infancy and childhood have the greatest risk of becoming chronic. Of the 2.6 crore (26 million) infants born every year in India, approximately one million run the life-time risk of developing chronic HBV infection. Hence the WHO recommends universal hepatitis vaccination in these regions.

HBV is found in all body fluids and has an incubation period averaging around four months. Members of this family of viruses have a narrow host range and predominantly infect hepatocytes in their respective hosts (Lamontagne et al., 2016). HBV infection can be either acute or chronic and may range from asymptomatic infection or mild disease to severe or rarely fulminant hepatitis (Lavanchy, 2004). Humans are the only

known natural host for HBV, although some non-human primates have been infected in laboratory conditions. HBV is relatively resilient and in some instances has been shown to remain infectious on environmental surfaces for about a week at room temperature.

1.2 Vaccination against HBV

Anyone who has not been vaccinated can get HBV. Infants and children are particularly vulnerable for chronic infections. Children contract the disease from their mother at the time of birth or simply from another child while playing through bite, cuts, scrapes, scratches or contact with wounds. Chronic infection from infancy is dangerous because of the liver damage and cancer. Child to child transmission is one of the common modes of transmission. The Govt. of India has initiated the incorporation of the vaccine in the Universal Immunization programme (UPI). The hepatitis B vaccine is the first vaccine against a cancer (primary liver cancer). The vaccine is safe and effective and has been available commercially since 1982. Hepatitis B vaccine are available as monovalent or stand alone and combination.

In the 1990s, the World Health Assembly first recommended the inclusion of Hepatitis B vaccine in routine infant immunization schedules. Hepatitis B vaccine given shortly after birth prevents HBV infection that occurs early in life. HBV infection acquired during infancy carries a greater risk of death later in life from cirrhosis and hepatocellular carcinoma. Coverage of immunization against HBV increased from the early 2000s with support from the Global Alliance for Vaccines and Immunization (GAVI, now known as the Vaccine Alliance) (WHO, 2009). The ILBL (Institute of Liver and Biliary Sciences) in New Delhi reported on the occasion of World Hepatitis Day 2014, on July 28 that India has over 40 million Hepatitis B (HBV) infected patients (second only to China) and constitutes about 15 per cent of the entire pool of Hepatitis B in the world. Tribal areas in India have high prevalence of Hepatitis B.

The WHO recommends that routine vaccination of all infants against HBV infection should become an integral part of national immunization schedule worldwide. High coverage with the primary vaccine series among infants has the greatest impact on the prevalence of chronic HBV infection in children. In the 14th meeting of Global Advisory Group (GAG) on Expanded Programme on Immunization (EPI) 1991, it was

recommended that Hepatitis B vaccine should be an integral part of the national immunization programmes worldwide by 1997. This decision was reaffirmed in the 45th World Health Assembly (1992). As the end of 2008, 177 countries have fully included and 2 countries have partially included this vaccine in their national immunization programmes. In countries that have implemented universal childhood Hepatitis B vaccination, chronic HBV infection and incidence rate of long-term complications like liver cancer have declined markedly. In 2015, global coverage with the three doses of Hepatitis B vaccine in infancy reached 84 percent. This has substantially reduced HBV transmission in the first five years of life, as reflected by the reduction in HBV prevalence among children to 1.3 percent. However, coverage with the initial birth dose vaccination is still low at 39 percent. Other prevention interventions are available but insufficiently implemented. When countries include Hepatitis B vaccine as a part of routine childhood immunization programmes, following sustained high coverage, HBV infection in children is essentially eliminated in 10 to 15 years resulting in significant reduction in long term complications of HBV infection such as cirrhosis and liver cancer later.

The standard paediatric dose of the Hepatitis B vaccines (monovalent Hepatitis B vaccine and combination) is 0.5ml. Each paediatric dose 0.5 ml contains 10 µg of antigenic component. It is a cloudy liquid that is available in a 10 dose vial and does not require reconstitution. It is recommended that the dose be doubled in adults, patients on hemodialysis, immuno compromised individuals and those with malignancies. Seroconversion rates are > 95percent, after three doses. An antibody titer of > 10mIU/ml is considered protective.

Since immunization at birth prevents horizontal transmission, vaccination should begin at birth if the mother's HBsAg status is not known. The Hepatitis B vaccination schedule in UIP includes Birth dose within 24 hour of delivery, followed by three more doses of Hepatitis B vaccine along with DPT or pentavalent. Birth dose should be provided for all institutional deliveries, within 24 hours of birth. Subsequently, three doses should be provided at 6, 10 and 14 weeks age along with three doses of DPT and OPV. Now the above three doses are included in pentavalent vaccine doses. Where

birth dose has been missed, it may be given at 6, 10 and 14 weeks of age. Currently there is no evidence to suggest that booster doses are required. Hepatitis surface antigen (HBsAg) screening should be offered to all pregnant women. If the mother is known to be HBsAg negative, vaccination of the child must begin within 24 hours of birth. Whether the mother's status is not known, it is safer to vaccinate the newborn within a few hours of birth. If the mother is known to be HBsAg positive the child must receive the vaccine, along with Hepatitis B immunoglobulin (HBIG) within few hours of birth at the separate site. HBIG provides immediate passive immunity and is used in circumstances where an acute exposure to HBsAg positive biological material has occurred. Combined passive and active immunization with concurrent use of HBIG and HBV vaccination results in 90 percent decrease in risk of HBV transmission in circumstances such as needle stick, injuries, sexual exposure or use of blood product not screened for HBV (Paul and Bagga, 2009).

2. Review of literature

Majority of the studies regarding Hepatitis B are focused on prevalence and its determinants. Vaccination status among health care workers is documented properly in some studies. Knowledge on Hepatitis B transmission among these health care providers is also found in studies in India. Studies related to coverage of birth dose of Hepatitis B are not properly documented but other immunization studies are large in number. Hence we reviewed some of the studies from the literature.

There is a serious dearth of data regarding the true prevalence of HBV in India. HBsAg positivity has been reported to range between 2 percent and 8 percent in most studies (Abraham, 2012; Thyagarajan et al., 1996; WHO, 2002). The most widely quoted figure of carrier rate in India is 4.7 percent with an estimated carrier population of 56.5 million (Thyagarajan et al., 1996).

Knowledge regarding the Hepatitis B virus and safety precautions is needed to minimize the acquired infections among health workers. They should have the complete knowledge of Hepatitis B infections, importance of vaccinations and practice simple hygienic measures apart from specific protective measures. One cross sectional

prospective study done by Siraj et al, (2015) revealed that there was good knowledge regarding transmission of HBV among medical staff where as 83 percent of paramedical staff had knowledge regarding sexual route, 72 percent about needles pricks, 75 percent knew about blood and body fluids and 70 percent vertical transmission. Regarding vaccination status, 42 percent of medical and 30 percent of paramedical staff was fully vaccinated, the most common reason for noncompliance being ignorance of importance of vaccination. Awareness of patients' vaccination status was also low. Mighlani (2014) in his study found that 100 percent awareness among doctors regarding transmission of disease whereas 82 percent nurses and 80 percent lab technicians had knowledge. Another study by Kasetty et al (2013) shows that 82 percent, 95 percent, 58 percent and 93 percent of paramedical staff had good knowledge about hepatitis infection and its transmission, vaccine, attitude towards HBV patients and post exposure prophylaxis respectively. Kumar et al (2014) in their study found that 46.2 percent of health care workers were fully vaccinated, 12 percent partially vaccinated and 41 percent not vaccinated. Another study reported that the complete immunization status of health care staff is 58 percent, and 18.5 percent are partially immunized and 24 percent are non-vaccinated against hepatitis B (Hussain et al, 2010). Chandra et al (2014) found that the overall proportions of complete, incomplete and unvaccinated health care staff with hepatitis B vaccine as 48.5 percent, 21.8 percent and 29.7 percent respectively. Knowledge among medical students in Ahmedabad concludes that there is lack of awareness about the hazards of Hepatitis B, its transmission and mode of transmission. Moreover, all the students were not vaccinated against Hepatitis B, which made them more vulnerable to the disease (Singh and Jain, 2011). A study conducted among nursing staff and nursing students in a tertiary medical college in Karad shows the knowledge on hand hygiene was moderate (Shinde and Mohite, 2014). Medical students are assumed to have more knowledge but one study shows that only about half of the students are aware that virus can be transmitted through percutaneous injury, 40 percent knew about the transmission through contact of mucous membrane with potentially infectious material, and 44 percent knew that it can be transmitted if breached skin comes in contact with infectious material. It was found that majority of the medical students had not received hepatitis B vaccination previously and 15.2 percent of them had incomplete vaccination (Rathi et al., 2018).

Generally, we assume that health workers by virtue of their proximity to the health facility should have adequate knowledge about diseases and other health conditions. Such a study in Uttar Pradesh assessed the knowledge regarding the hepatitis infection among patients and concluded that there was poor knowledge and awareness about the hazards of Hepatitis B, its mode of transmission and prevention. Majority of the patients were not fully vaccinated against Hepatitis B and were not aware about the availability of post exposure prophylaxis (Singh et al, 2018).

Many of studies are based on data from blood banks and may not truly reflect the general population's awareness and prevalence. One study in Kerala analyzing prevalence of diseases using hospital data of 5 years shows that 6.35percent of the patients attended in the hospital were due to Hepatitis B. The high risk groups were the adults in the age group of 20-39 years and males (Jimmy and Celine, 2014). In another hospital based study from north Kerala, HBsAg positivity ranged from 0.71percent to 4.49 percent among high risk groups (Sandesh, et al, 2006). Since 2005 there have been several reports of hepatitis B outbreak in Kerala. Some of them have been reported in the media also. Only very few studies have been reported in medical literature. A community based study (Kuriakose and Ittyachen, 2018) in Ernakulam district reveals that 59 patients had reported acute Hepatitis B. None of the patients had received vaccination against Hepatitis B. Out of these, 44 of them are included in the conventional exposure group and 15 patients had not reported any known risk factors for Hepatitis B but claimed to have been bitten frequently by an unidentified fly.

Without immune prophylaxis, in mothers who are both HBsAg and HBeAg positive, the risk for transmission to the baby is between 70 and 90 percent by 6 months of age. One study found that 38 percent of babies born to HBsAg positive mothers, who did not acquire infection perinatally, became infected by four years of age (Beasley and Hwang,1983). This emphasizes the need to equip mothers with knowledge to prevent horizontal transmission of Hepatitis B infection, and the importance of completion of the Hepatitis B vaccination schedule.

The risk for development of chronic Hepatitis B infection varies inversely with the age at which infection occurs, 90 percent of affected infants develop chronic infection as opposed to 30-50 percent of under-five children and 6 percent of children above five

years of age (WHO, 2012; Hyams, 1995). Chronic Hepatitis B infection acquired in childhood carries a 25 percent risk for development of chronic liver disease, cirrhosis or hepatocellular carcinoma (Shapiro, 1993). Risk of chronicity is 90 percent in neonates and 20- 60 percent in children under the age of 5 years while it is less than 5 percent when acquired in adulthood (McMahon, 2004; Hoofnagle et al., 2007).

A combination of active and passive immune prophylaxis is the optimum strategy to prevent HBV infection in babies of HBsAg positive mothers. A combination of Hepatitis B immunoglobulin (HBIG) and Hepatitis B vaccination initiated within 24 hours of delivery has been shown to protect 85 to 95 percent of babies whose mothers were positive for both HBsAg and HBeAg (Andre,1994). However, studies have shown significant gaps in hospital practices and policies to prevent vertical transmission of Hepatitis B (Willis et al., 2010).

Administration of single antigen Hepatitis B vaccine soon after birth is critically important for the prevention of perinatal and early postnatal transmission of HBV infection, and is much more efficacious for this purpose than doses given after the neonatal period, since the efficacy of post exposure prophylaxis diminishes with increasing time since exposure (WHO, 2009). Administration of Hepatitis B vaccine at birth within 24 hours prevents 95 percent of peri-natally acquired Hepatitis B Virus infections, averting 15percent of total burden.

The birth dose is recommended for all newborns since it serves as a safety net, due to the fact that errors in testing, reporting and documenting maternal HBsAg status do occur (Anderson and Wexler, 2005). Moreover, the chance for completing the Hepatitis B vaccine schedule and in fact all other immunizations, is found to improve when vaccination is initiated at birth.

Holla et al compared two data one comprising the data of a Private Rural Medical College in Karnataka and newborn vaccination data of four selected Government Planning Units under 37 ANMs. Findings show that the overall coverage of Hepatitis B birth dose was 56percent. Hepatitis B birth dose coverage was low in Private facilities

than in Govt. facilities. In the Private Rural Medical College, annual Hepatitis B birth dose coverage within 24 hours was only 26.5percent, within 48 hours was 53percent. Qualifying Hepatitis B birth dose coverage was 56 percent in the catchment area of four planning units where as it was 26 percent in the rural Medical College. Missed opportunity was 11.7percent in the College and 30.57percent in the planning unit area. Hepatitis B birth dose coverage within 24 hours was 26.5percent in the Medical College which rose significantly from 19 percent in April 2014 to cent percent in July/August 2014 through intervention (Holla et al, 2017).

Aggarwal et al (2014) conducted a study during 2010-11 in five districts of Andhra Pradesh where Hepatitis B immunization (HB immunization) had been introduced in 2003-04. The study results from children aged 5-11 years found that anti-HBs positivity was higher among immunized than in unimmunized children (53 percent vs. 18percent), and anti-HBc positivity was lower (1.1percent vs 10.8percent). HBsAg positivity was low in both the groups (0.15percent and 0.17percent). Anti-HBs positivity rate declined with increasing age.

Knowledge and practices towards Hepatitis B virus and immunization against the prevention of Hepatitis B infection (especially about immunization of Hepatitis B0 or birth dose) among the Pediatricians, Staff Nurses and other Health Staff working in the labour room and immunization activities are very much important for the prevention, intervention and curative activities of Hepatitis B infection. Studies related to prevalence and determinants of Hepatitis infection, knowledge on hand hygiene, attitude and practices towards Hepatitis B virus and Hepatitis B infection are there but studies related to immunization practices and coverage of Hepatitis B vaccine (especially about immunization of Hepatitis B0 or birth dose) are very few in India. Kerala is not an exception in this regard. Since immunization at birth prevents horizontal transmission, vaccination should begin at birth if the mother's HBsAg status is not known. Hence the present study on assessment of Hepatitis B0 vaccine coverage in Kerala is relevant.

3. Objectives

- 1) To analyze the coverage of Hepatitis B birth dose (Hepatitis B0) in Kerala using HMIS Portal data

2) To assess the knowledge about Hepatitis B0 vaccine, ideal practices and safe storage of Hepatitis B0 vaccine among health staff and Pediatricians in selected Govt. district hospitals and private hospitals in Kerala.

4. Data and Methodology

In order to analyze coverage of Hepatitis B0 in Kerala, HMIS data from during two years in the state and districts are used. A macro level analysis of monthly consolidated HMIS data for the period from April 2017 to February 2019 has been done for assessing the district wise variation in coverage of birth doze of Hepatitis B in Kerala. The data from the site of www.nrhm.nic.in has been used for the analysis. All the hospitals in the country report the health statistics in the portal designed by Ministry of Health and Family Welfare. Apart from public health facilities all the registered private hospitals also report the monthly health statistics to the portal through the Block level health facilities or District level health facilities. Though the coverage of data is not fully ensured from the private health facilities, the details of births, delivery and basic immunization services are properly reported. The data goes through different validation process. However, the accuracy of the HMIS data is not fully ensured and thus it is not widely used. The first section tries to utilize the HMIS data to understand the level of coverage of different birth dozes in Kerala and its districts. The coverage of each birth doze has been calculated by dividing the number of newborn vaccinated against the particular vaccine by the number of live birth in the district. For assessing the effect of preterm babies and low birth weight babies, an adjusted coverage of Hepatitis B0 is calculated replacing the live births in the denominator by reducing the number of preterm and low birth weight babies from the live birth. Likelihood of gap in coverage is estimated for assessing the gap of coverage in each district in the State.

In order to know the ideal practices we visited eight hospitals and interviewed pediatricians and observed the practices and storage of vaccine. To assess knowledge of nursing staff and other responsible staff in the labour room and immunization sections regarding Hepatitis B, vaccine storage, injection details, schedule of the vaccine, we interviewed JPHN, LHI and Staff nurses in the hospitals.

Eight district hospitals from six districts in Kerala namely Kannur, Kozhikode, Malappuram, Thrissur, Alappuzha and Thiruvananthapuram are covered. From Thiruvananthapuram district two private hospitals, namely PRS Hospital, Karamana and SN Mission Hospital, Varkala are also included. Each hospital has an ideal practice regarding the vaccination which is under the supervision of pediatrician in the hospital. Hence to assess the ideal practice, pediatricians in these hospitals are interviewed. From six districts, we interviewed 10 JPHNs, 8 LHIs and 28 staff nurses who are engaged in the routine immunization or in charge of vaccine storage. We observed how the vaccine is stored. A structured schedule was used to collect information about ideal practice regarding the vaccination of Hepatitis B doses in the hospital and the knowledge about transmission and prevention method of Hepatitis B virus and practice towards prevention of HBV.

5. Findings

5.1 HMIS Data Analysis

The reported coverage of birth dose of Hepatitis B in Kerala is about 65 percent for both 2017-18 and 2018-19. But a large level district wise variation also exist as per the data. Pathanamthitta (97.5 percent) and Kottayam (95 percent) recorded highest coverage followed by Wayanad (93 percent), Idukki (90.6percent) and Kollam (90 percent) in 2017-18. In the next year Kottayam (95.4percent) and Pathanamthitta (93.5percent) have recorded more than 90 percent of coverage.

The coverage in the district like Kollam, Wayanad and Idukki has declined. By going through the graph, we can see that Kasaragod followed by Malappuram and Kannur experienced lowest level of coverage in both the years. While the districts like Alappuzha, Thrissur, Palakkad, Malappuram, Kozhikode, Kannur and Kasaragod has continued the same coverage in 2018-19, Thiruvananthapuram and Wayanad has recorded sharp decline in coverage. Ernakulam has experienced 17 percent increase in the coverage.

The districts like Thiruvananthapuram, Malappuram, Kannur and Kasaragod has recorded lower level of coverage of the vaccine which needs to be further analyzed. Various reasons are pointed out for the lower coverage of birth doze of Hepatitis B in the State. Shortage of vaccine, adherence of new guidelines etc are some of the reasons.

Figure 5.1: District wise coverage of Hepatitis B0, 2017-19

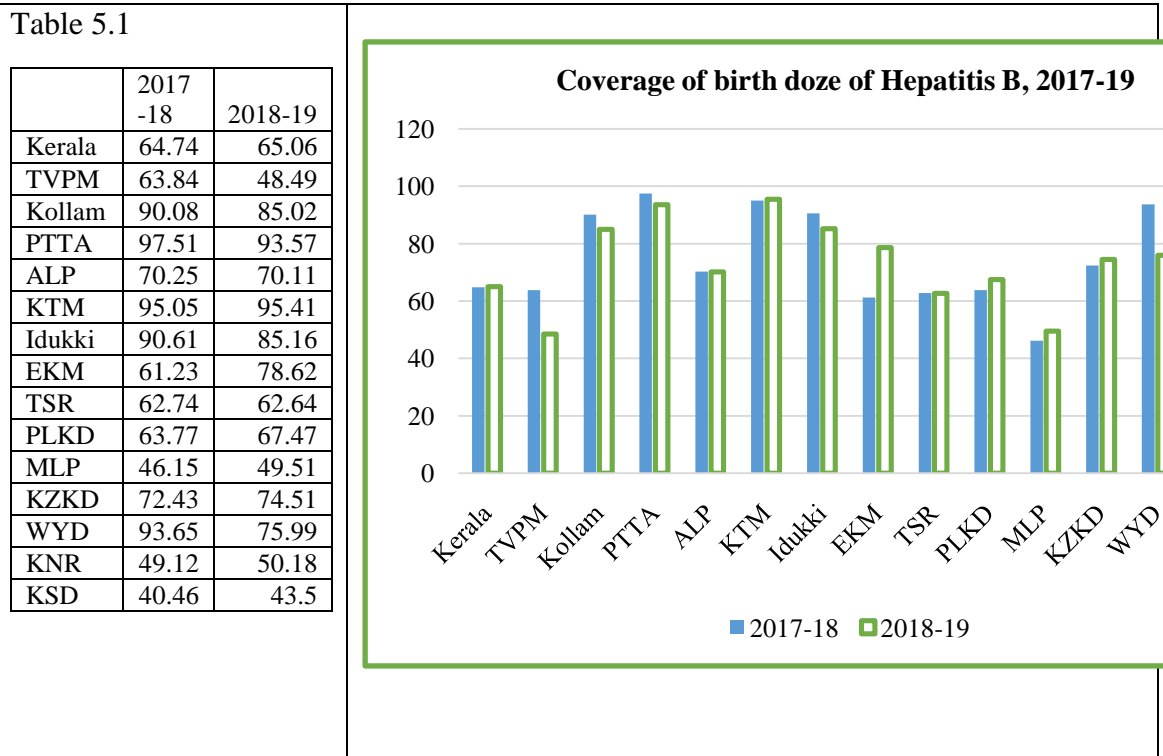


Table 5.2 : Monthly coverage of birth doses in Kerala, 2017-18

		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	Total
Kerala	BCG	108.38	101.71	101.67	106.54	105.14	105.54	96.85	101.02	96.89	100.05	98.78	94.71	101.62
	OPV	104.28	98.56	97.73	101.86	100.88	100.81	92.34	94.68	89.69	96.1	94.12	90.11	97.01
	Hep B0	66.54	63.46	62.1	64.34	63.56	62.48	62.51	69.93	63.82	66.22	66.56	67.11	64.74
	AdjHep B0	74.56	71.15	71.33	73.42	72.73	71.34	71.04	79.85	73.38	77.16	77.13	78.25	74.01
Thiruvananthapuram	BCG	111.35	77.38	94.88	99.31	96.73	99.5	98.58	90.32	86.81	74.79	86.99	84.75	92.25
	OPV	110.67	77.05	95.13	96.93	96.75	98.02	98.31	91.16	84.17	73.87	80.26	83.73	91.17
	Hep B0	74.02	58.39	79.54	82.53	64.88	70.89	79.01	68.29	42.98	42.6	35.64	38.11	63.84
	AdjHep B0	83.33	63.68	94.43	94.07	75.16	81.85	92.09	78.96	45.84	45.33	39.74	44.3	72.45
Kollam	BCG	137.52	108.39	97.9	105.21	99.77	111.72	98.69	102.59	97.07	100	98.57	86.61	103.82
	OPV	100.6	103.47	101.26	100.22	98.78	108.56	99.04	78.2	91.85	95.25	98.15	84.69	96.74
	Hep B0	88.05	100.91	97.94	93.79	86.36	78.36	89.03	117.94	85.66	70.12	81.57	82.37	90.08
	AdjHep B0	96.23	110.15	107.36	103.03	91.2	86.57	102.3	127.07	93.26	75.71	86.99	87.5	98.13
Pathanamthitta	BCG	100.33	101.75	101.26	104.69	102.31	101.61	99.69	99.84	101.25	100.91	101.8	102.2	101.44
	OPV	99.75	95.63	100.81	103.91	101.47	100.89	99.69	99.76	100.42	100.5	102	101.4	100.48
	Hep B0	88.13	96.98	99.41	97.13	99.92	97.02	97.05	97.81	99.09	98.68	99.08	99.74	97.51
	AdjHep B0	99.17	111.3	114.07	115.62	119.8	117.02	114.57	120.02	114.51	116	116.3	117.9	114.57
Alappuzha	BCG	71.24	85.9	94.23	90.44	114.31	87.1	83.66	104	100.57	95.03	104.1	98.61	92.9
	OPV	64.75	84.32	92.94	93.22	112.64	81.76	82.5	97.51	95.26	89.74	101.1	95.53	89.9
	Hep B0	56.38	79.4	63.9	57.99	75.99	63.47	85.35	69.26	75.74	72.2	62.37	81.41	70.25
	AdjHep B0	79.14	92.42	67.81	64.12	66.47	72.88	102.02	66.59	75.32	75.97	59.9	82.55	75.61
Kottayam	BCG	102.4	106.53	105.18	105.66	104.97	103.77	104.64	100.67	102.14	102.43	98.61	103.9	103.48
	OPV	86.39	107.33	105.09	105.86	104.04	102.37	103.14	98.97	98.46	102.93	99.73	103	101.45
	Hep B0	95.45	96.13	96.31	97.28	90.46	95.21	97.39	95.25	94.67	96.02	88.9	97.25	95.05
	AdjHep B0	108.21	109.63	116.35	117.73	111.19	114.58	118.02	116.11	117.3	113.37	107.2	119.1	113.95
Idukki	BCG	99.26	106.81	102.3	104.58	114.16	117.9	105.29	131.3	91.45	105.37	102.4	86.64	105.8
	OPV	105.06	107.8	103.45	108.13	111.86	115.84	104.45	127.75	89.61	95.4	97.97	66.78	103.06
	Hep B0	85.7	65.45	92.69	101.15	98.6	105.1	101.67	110.54	86.36	68.24	86.17	88.47	90.61
	AdjHep B0	95.73	73.91	105.47	112.78	114.2	126.17	121.83	132.1	102.57	79.87	101.8	105	105.38

		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	Total
Ernakulam	BCG	100.75	97.59	100.3	100.25	93.52	97.1	98.73	98.92	99.88	96.38	102.1	99.63	98.72
	OPV	100.34	97.4	97.63	100.83	97.82	95.12	95.68	93.49	95.75	94.17	101.2	97.96	97.36
	Hep B0	59.25	49.87	44.42	37.93	55.72	46.1	65.46	76.74	76.04	75.87	85.03	86.01	61.23
	AdjHep B0	69.05	57.89	51.51	43.63	65.01	54.89	77.21	89.22	95.48	96.56	99.85	105.5	72.44
Thrissur	BCG	91.75	92.12	93.29	100.83	98.97	105.63	99.56	104.4	98.68	89.47	76.58	74.58	94.06
	OPV	90.08	88.9	77.85	80.33	91	98.66	91.46	96.39	89.51	90.5	74.61	71.46	86.83
	Hep B0	62.33	61.59	58.52	56.82	63.03	62.16	61.99	75.15	69.99	66.19	61.55	54.46	62.74
	AdjHep B0	69.12	68.27	68.63	61.92	68.28	66.36	66.46	81.71	74.92	72.13	69.69	61.35	69.03
Palakkad	BCG	114.41	108.45	104.76	121.73	125.92	121.74	88.25	112.48	96.22	112.5	109.3	103.2	109.66
	OPV	106.05	104.8	102.51	121.5	123.88	121.28	83.98	103.14	80.13	100.36	94.33	93.38	103.06
	Hep B0	62.22	53.2	50.35	62.93	64.5	77.39	61.5	68.32	58.15	71.24	72.52	69.8	63.77
	AdjHep B0	71.25	58.94	56.56	70.17	72.62	86.87	68.45	75.12	64.95	84.04	84.09	81.01	71.97
Malappuram	BCG	96.3	100.32	86.68	106.05	96.16	103.66	91.76	90.16	99.21	105.21	97.71	93.65	97.01
	OPV	90.76	88.89	74.9	96.72	85.79	85.23	77.2	81.67	85.1	95.09	86.32	82.33	85.72
	Hep B0	47.97	53.42	35.71	47.07	49.27	39.23	40.76	48.64	44.95	45.88	48.81	51.43	46.15
	AdjHep B0	52.04	59.18	39.47	52.79	54.7	43.88	44.86	55.46	53.99	55.77	56.99	58.16	52.08
Kozhikode	BCG	136.93	101.7	105.74	109.06	98.89	100.5	97.89	119.14	110.18	114.07	113.9	110	109.78
	OPV	136.39	100.97	104.84	108.07	98.06	100.11	97.3	116.98	109.94	113.66	113.6	108.6	108.98
	Hep B0	83.22	69.87	66.72	75.64	56.34	61.32	63.38	72.98	74.83	85.9	84.85	79.28	72.43
	AdjHep B0	93.56	79.7	77.92	90.72	67.82	74	75.62	90.25	90.37	110	107.6	102.3	87.11
Wayanad	BCG	130.37	132.07	125.17	121.45	122.89	103.23	101.32	99.76	93.94	97.16	97.59	96.61	110.22
	OPV	129.83	128.59	115	119.2	118.52	107.62	102.81	98.37	90.19	94.32	92.23	95.21	107.62
	HepB0	106.78	106.81	91.31	98.75	98.84	85.48	86.38	91.46	88.23	92.75	87.63	88.13	93.65
	AdjHep B0	136.69	130.26	116.04	122.59	117.83	101.06	101.03	102.18	96.46	109.63	98.81	104.5	111.15
Kannur	BCG	99.65	106.97	106.03	99.92	104.2	93.84	81.28	94.09	91.66	103.7	98.08	97.08	97.98
	OPV	104.6	106.8	104.49	93.15	100.06	89.4	79.4	86.88	77.41	102.29	96.47	94.54	94.94
	Hep B0	61.13	55.04	62.28	45.83	52.83	39.63	31.21	34.6	46.06	55.4	51.32	59.37	49.12
	AdjHep B0	68	60.9	74.59	51.3	60.48	44.68	34.19	38.31	50.82	62.69	58.6	68.81	55.36

		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	Total
Kasaragod	BCG	133.96	168.57	180.1	151.6	177.91	175.61	146.63	96.36	67.4	105.02	110.2	93.19	135.13
	OPV	145.38	174.63	186.53	145.08	146.39	179.18	142.11	93.89	68.58	103.55	110.7	93.13	133.76
	Hep B0	34.86	30.13	34.09	46.96	37	75.74	30.48	37.07	25.23	43.84	46.33	49.75	40.46
	AdjHep B0	37.73	34.68	36.18	54.24	42.67	81.68	34.25	39.79	27.56	47.09	50.04	53.77	44.51

Table 5.3: Monthly coverage of birth doses in Kerala, 2018-19

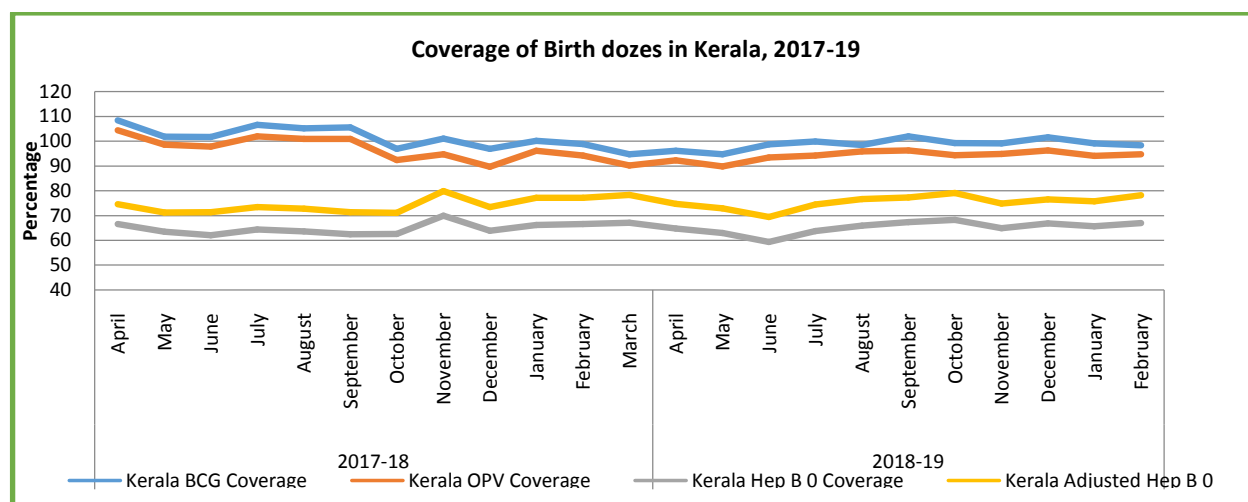
		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Total
Kerala	BCG	96.03	94.67	98.65	99.78	98.37	101.9	99.13	99.0	101.5	99.1	98.3	98.71
	OPV	92.21	89.8	93.32	94.15	95.81	96.19	94.22	94.83	96.16	94	94.7	94.05
	Hep B0	64.72	62.88	59.38	63.66	65.94	67.36	68.18	64.9	66.79	65.7	66.9	65.06
	AdjHep B0	74.64	72.92	69.34	74.46	76.58	77.21	79.09	74.84	76.44	75.7	78.1	75.32
Thiruvananthapuram	BCG	96.22	89.42	101.8	100.5	101.64	100.1	102	99.7	104.6	108	102	100.2
	OPV	82.81	84.41	93.02	94.66	93.64	93.69	95.35	94	97.24	103	97	93.13
	Hep B0	51.73	53.54	43.43	41.62	44.26	45.21	42.5	42.57	47.27	66.9	61.3	48.49
	AdjHep B0	61.24	62.75	55.03	52.25	56.51	49.86	51.03	54.34	65.69	86.7	82.2	60.11
Kollam	BCG	99.4	96.69	91.85	103.3	95.36	106.5	100.4	90.82	102.1	88.5	89.6	96.89
	OPV	94.72	93.81	96.1	93.49	105.16	97.49	100.7	92	95.65	66.4	89.8	93.65
	Hep B0	91.2	89.9	90.32	88.2	97.94	91.27	89.72	84.55	90.63	44.2	67.2	85.02
	AdjHep B0	99.54	102.5	98.43	97.7	105.76	96.99	97.62	95.21	99.27	49.2	74.3	93.47
Pathanamthitta	BCG	99.76	95.94	102.5	99.58	101.49	101.1	104.5	99.6	101.5	101	101	100.7
	OPV	100.08	95.57	102.1	99.24	100.86	98.86	104	100.1	100.5	100	101	100.2
	Hep B0	74.6	73	99.37	98.57	98.44	98.48	100.4	99.29	99.16	90.3	99.2	93.57
	AdjHep B0	88.5	90.96	117.7	119.4	115.5	141.8	117.7	119.7	110.1	105	117	112.6
Alappuzha	BCG	95.54	93.84	99.44	94.13	104.44	99.67	100.5	100.3	98.45	96.8	88.2	97.44
	OPV	93.45	91.17	96.9	93.22	102.43	82.68	87.68	96.15	96.52	96.5	86.3	92.79
	Hep B0	90.32	81.22	59.87	77.17	78.13	73.23	74.59	49.24	53.59	64.7	66.2	70.11
	AdjHepB0	94.53	86.55	60.21	81.98	74.8	73.47	74.19	49.07	54.44	66.8	75	71.95

		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Total
Kottayam	BCG	103.83	103	103.3	104.2	103.46	105.4	102.8	94.76	103.3	104	102	102.7
	OPV	102.2	102	102.4	102.7	102.57	103.9	102.3	93.29	101.9	102	103	101.6
	Hep B0	93.56	96.77	94.28	94.41	93.43	95.4	97.12	91.92	95.26	99.3	97.8	95.41
	AdjHep B0	114.43	118.7	114.1	110.2	111.43	114.1	113.9	111.3	113.2	116	115	113.8
Idukki	BCG	108.88	99.11	104.7	104.1	105.15	110.2	103.2	104.8	107.8	99.4	103	104.5
	OPV	110.36	97.74	98.56	100.6	105.81	94.55	100.4	101.6	110.4	99.9	103	101.9
	Hep B0	90.43	85.24	72.95	78.56	73.57	91.13	89.65	94.8	94.01	79.6	86.2	85.16
	AdjHep B0	104.47	97.96	86.24	91.07	85.26	108.9	107.6	110.8	107.1	93.2	103	99.64
Ernakulam	BCG	97.53	93.24	103.2	101.5	97.79	101.8	98.81	96.15	99.74	102	100	99.2
	OPV	98.52	92.08	102.2	100.2	96.15	100.6	96.71	95.11	98.22	101	99.1	98.09
	Hep B0	83.73	70.29	75.69	77.36	77.76	84.01	80.08	77.81	81.39	86.3	69.9	78.62
	AdjHep B0	106.53	88.45	95.67	95.96	96.99	105.1	104.9	101.5	101.8	113	84.3	99.48
Thrissur	BCG	95.86	97.21	102.3	99.71	99.12	101.6	96.56	97.23	101.2	107	98	99.46
	OPV	96.45	93.13	96.57	88.23	97.48	98.46	95.33	101.4	95.95	102	94.3	96.31
	Hep B0	60.6	64.13	68.16	60.39	61.23	61.56	59.52	68.27	62.34	63.5	58.2	62.64
	AdjHep B0	68.29	70.73	76.02	70.13	67.27	67.95	66.45	73.76	68.14	70.6	64.9	69.59
Palakkad	BCG	101.8	103.4	105.5	102.5	103.27	104.4	101.1	100.6	97.65	97.5	105	102
	OPV	97.63	98.58	102.4	98.5	99.16	99.23	98.04	98.02	94.08	94.5	101	98.27
	Hep B0	68.75	71.3	70.14	68.84	69.21	49.25	65.66	63.48	61	68.5	85.8	67.47
	AdjHep B0	77.96	86.93	80.11	79.9	79.33	56.37	76.08	72.5	69.61	77.8	102	78
Malappuram	BCG	88.3	89.7	94.43	94.97	90.43	104.7	92.75	99.31	101.3	96.9	97	95.16
	OPV	81.96	81.03	83.74	86.13	82.55	92.42	80.25	91.13	91.68	86.5	85.6	85.5
	Hep B0	46.55	41.14	40.44	55.4	44.81	56.06	50.5	62.8	49.24	47.3	53.6	49.51
	AdjHep B0	51.67	46.25	45.71	61.55	49.82	62.34	55.93	69.66	53.52	51.3	59.3	54.94
Kozhikode	BCG	100.18	93.31	97.42	101.2	101.86	97.56	114.1	102.7	101	100	102	100.8
	OPV	98.6	92.2	96.18	100.3	101.95	96.28	113.5	98.02	97.01	101	101	99.38
	Hep B0	69.34	63.1	64.93	67.24	72.2	76.19	98.6	69.91	89.91	84.9	67.7	74.51
	AdjHep B0	83.07	73.53	80.28	81.52	87.31	91.6	124.8	81.9	102.2	96.8	80.9	88.87

		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Total
Wayanad	BCG	93.89	101.2	94.71	103	100.98	94.78	99.76	102.5	98.93	80	92.1	96.33
	OPV	74.66	97.07	97.19	100.4	98.49	92.64	94.67	78.62	78.61	74.9	89.1	88.4
	Hep B0	79.31	77.87	59.8	65.47	82.45	77.23	75.64	75.38	77.29	75.4	88.5	75.99
	AdjHep B0	90.74	91.49	70.19	92.04	93.28	87.23	87.4	88.56	87.89	86.4	98.4	88.55
Kannur	BCG	94.41	95.11	95.69	96.72	95.71	102.8	88.93	101.1	99.18	99.8	99.3	96.97
	OPV	93.32	85.74	88.44	95.92	95.09	101.3	85.3	99.72	98.89	94.5	97	93.85
	Hep B0	54.7	62.19	36.26	48.04	60.25	63.32	57.86	37.59	38.55	40	50.7	50.18
	AdjHep B0	61.46	69.76	40.55	53.68	70.05	69.13	63.86	40.35	42.33	44.6	57.2	55.87
Kasaragod	BCG	92.46	95.9	94.15	106.5	100.31	93.38	98.02	97.95	112.4	92	85.7	97.38
	OPV	93.07	84.51	75.78	83.07	98.58	91.03	92.69	82.58	100.5	87.4	87.5	88.74
	HepB0	34.94	37.09	34.76	33.92	56.37	43.65	48.9	38.16	67.56	47.2	37	43.5
	AdjHep B0	38.0	40.3	38.6	37.74	61.44	47.39	52.35	40.98	71.26	52.3	40.4	47.31

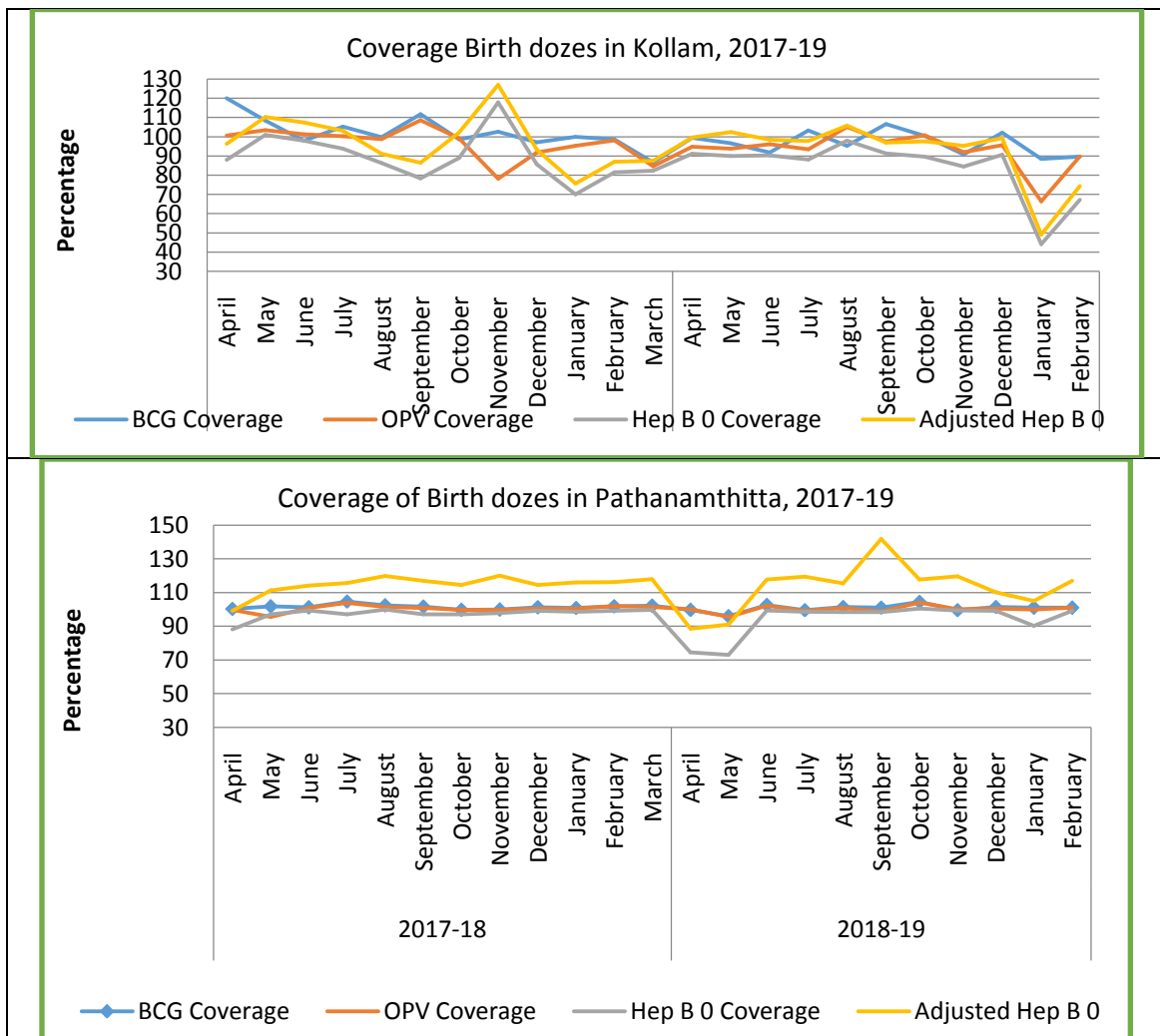
Month wise coverage of all the birth doses of immunization is given (Table 2 & 3). Graphical representation of coverage of birth doses in Kerala over the period of two years from April 2017 to February 2019 shows a zigzag nature throughout the period. Coverage of BCG which was above 100 percentage till November 2018, and has declined to 94 percent and the average figure hovered around 100 percentage over the period. Coverage of BCG and OPV has also incorporated to assess the calculation errors of vaccination coverage over the period. As BCG can be taken within one year of delivery, and OPV in 15 days, there are chances of outnumbering the number of live births by the number of children immunized for both birth doses. But the general pattern in the State points that all the children are getting their birth doses apart from Hepatitis B on the day of routine immunization. In general, birth doses of both OPV and BCG are complete in the State over the period of 23 months. But the same pattern is not visible in the case of Hepatitis B. Over the period of study, the percent of Hepatitis B0 in the State has not improved beyond 65 percent. It was almost travelled in a same pace except November 2017. Yet, it has never touched 70 percent of coverage. The gap of nearly 30 percentage need to be explained in further research. However, an attempt has been made to assess the role of low birth weight for the lower immunization coverage. As per the early guidelines, newborn having birth weight below 2 Kg has not been vaccinated against Hepatitis B. Adjusted Hepatitis B coverage has been calculated by reducing the pre- term and low birth weight babies from the denominator (live birth).

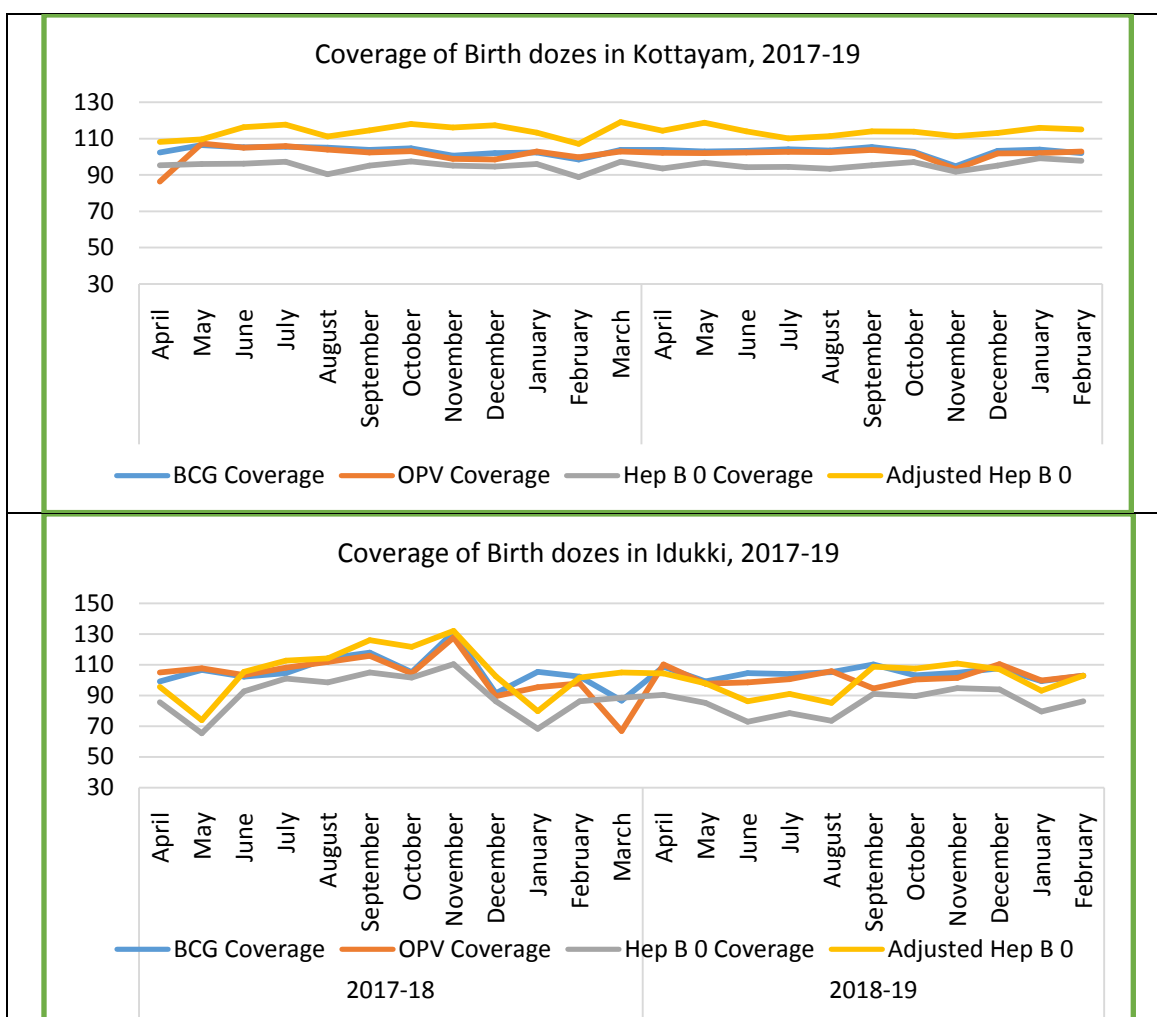
Figure 5.2 Monthly coverage of birth doses in Kerala, 2017-19



The districts are classified into three based on the level of coverage during 2018-19. The southern districts like Kollam, Pathanamthitta, Kottayam and Idukki has reported more than 80 percent of coverage in the above period. Alappuzha, Ernakulam, Thrissur, Palakkad, Kozhikode, and Wayanad have recorded an average coverage between 50 to 80 percent during the period. Four districts namely Thiruvananthapuram, Malappuram, Kannur and Kasaragod have reported lower coverage and are grouped into one.

Figure 5.3: Coverage of birth doses in Kollam, Kottayam, Pathanamthitta and Idukki

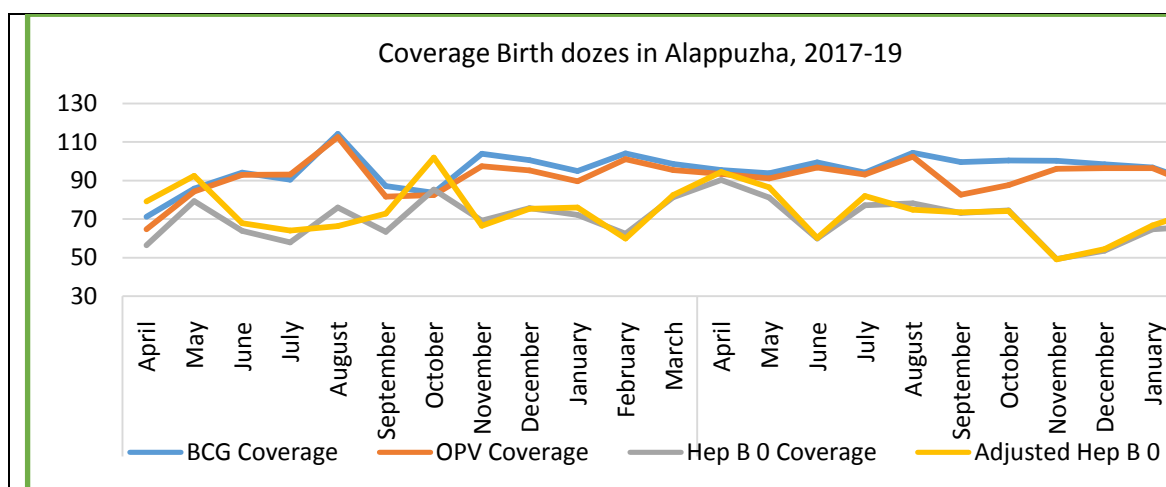


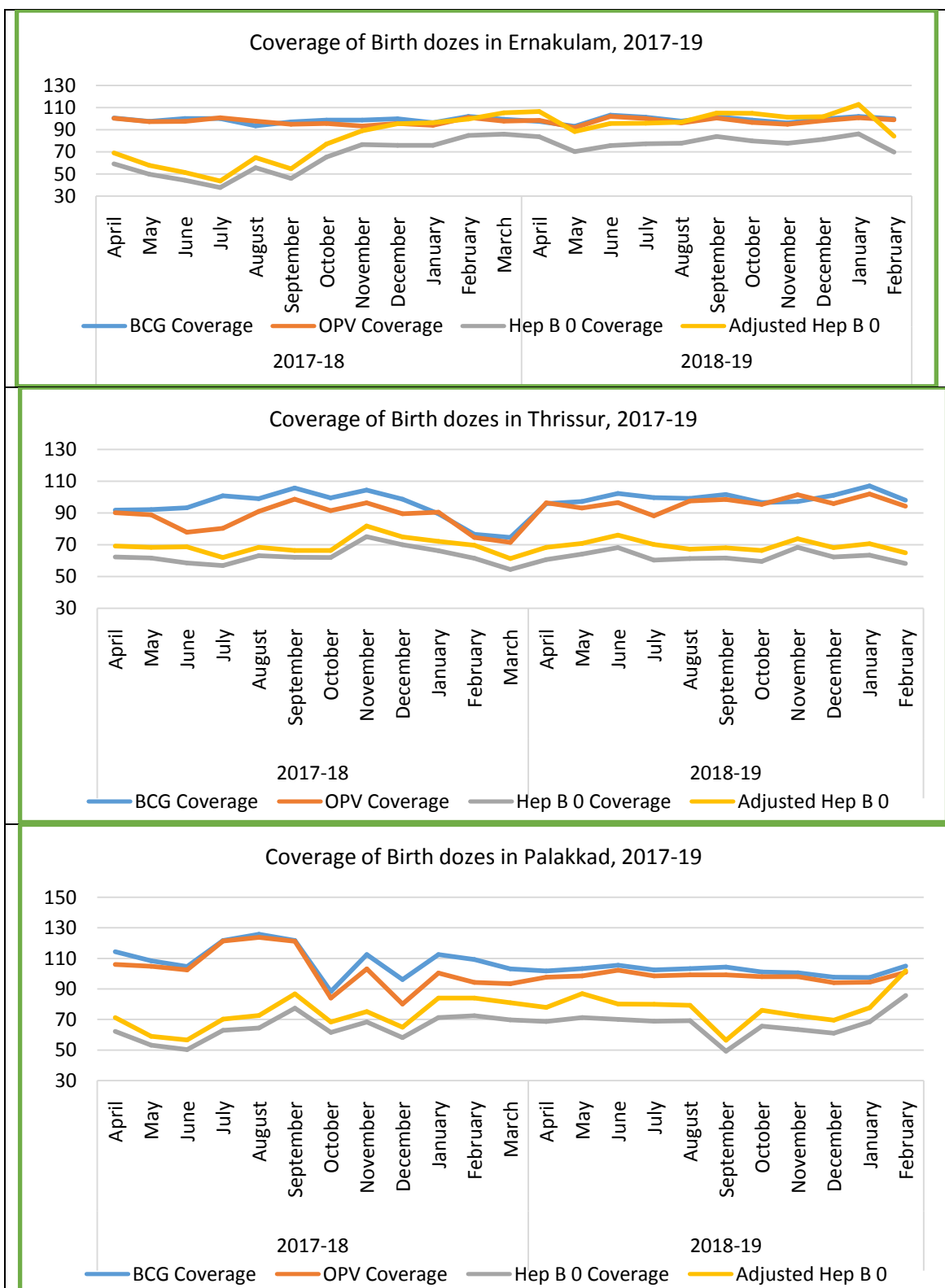


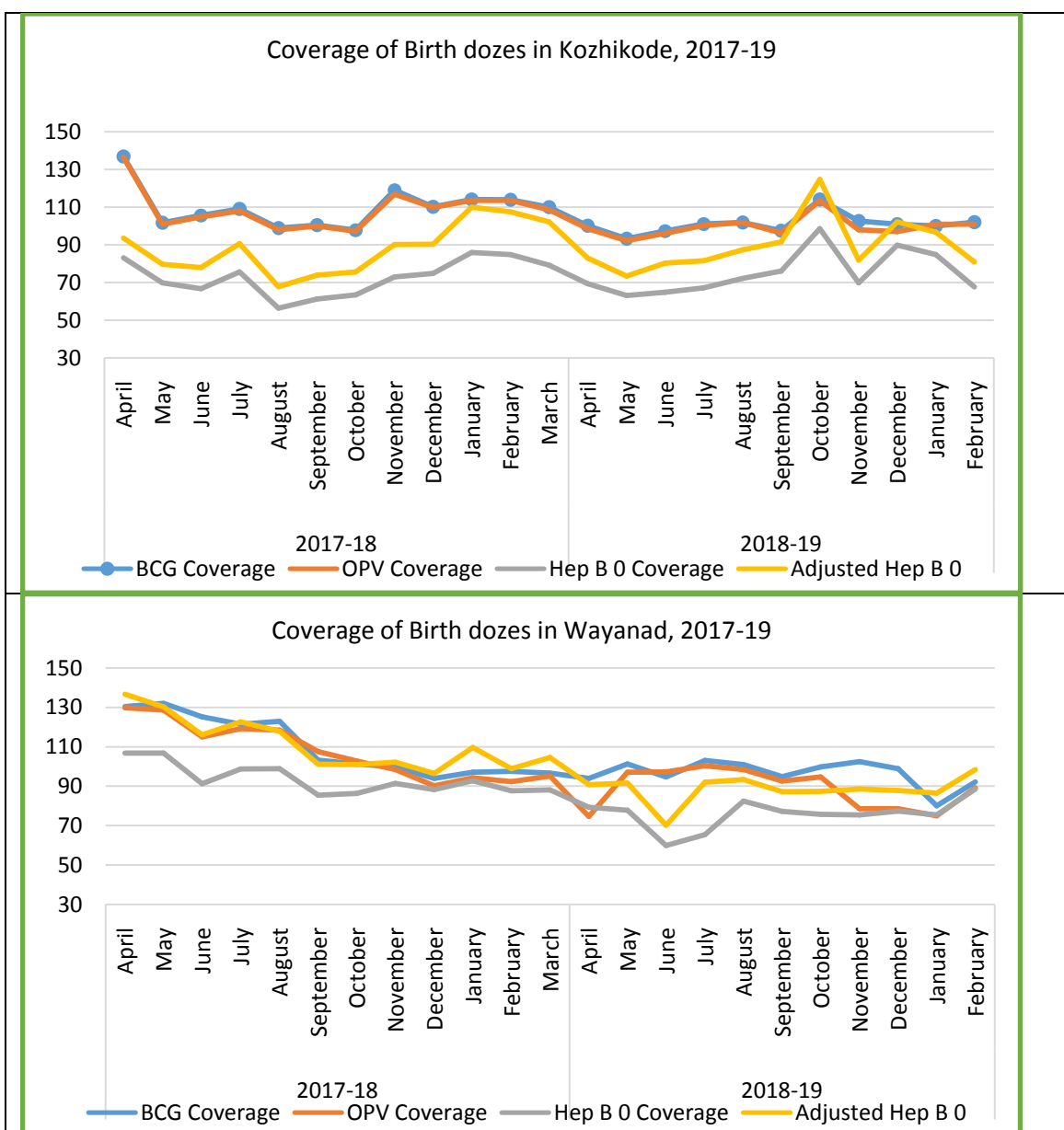
Districts like Kollam, Pathanamthitta, Kottayam and Idukki has reported coverage of Hepatitis B and other birth dozes in a consistent manner over the period. The coverage was more or less higher than 80 percent throughout the 23 months in these districts. We cannot see much difference in the coverage of different birth dozes. Kollam district has recorded BCG and OPV higher than 100 percent during April, May and September 2017. Though OPV also recorded values more than 100 percentage, but coverage of BCG seems to be more flawed. During the month of November, 2017 the coverage of birth doze of Hepatitis B has reached 117 percent in Kollam, which points towards data discrepancies in the district. Coverage of 100 percentage of birth doze does not ensure the reality in the field. Data quality needs to be monitored. At the same time, the figures have remained below the level of 100 percent during 2018-19. Hepatitis B coverage also remained around 85-90 percent during the period till January, 2019. During January, 2019 the coverage has sharply declined to 44 percent and then increased to 67

percent in the next month. Such zigzag flow of coverage of Hepatitis and other birth doses point towards low quality data in the district. The coverage of all the three birth doses in Pathanamthitta flowed in the same pace throughout the period, which points towards more data accuracy in the district. The adjusted Hepatitis B in the district has crossed 100 percentage throughout the period. The coverage of Hepatitis B has declined to 74 percent in April and May, 2018 but the other vaccines have remained in the same pace, which need to be rechecked. Hepatitis B coverage in Kottayam seems to be accurate and had a unique pace throughout the months of study. Coverage has neither crossed 100 percentage nor flowed below 90 percentage. Not only, Hepatitis B, other vaccinations also recorded the same pace. Data accuracy appears to be fine in the district with adjusted Hepatitis B0 more than 100 percentage every month. Idukki district also had a coverage of more than 85 percent during the period. Apart from the earlier mentioned three districts, data accuracy in Idukki needs to be verified. The last part of figure 3 clearly points the zigzag nature of the coverage of Hepatitis B in the district over the months. Not only, Hepatitis B, all the other basic vaccines also shown a same pace, which exceeded 100 percent in more than half of the months in 2017-18. But the outflow has reduced during the next year. Data quality in the district can be targeted as the values of coverage of Hepatitis B in the months of July, September, October and November 2017 has exceeded more than 100 percent which is literally not possible.

Figure 5.4: Districts with medium coverage of Hepatitis B





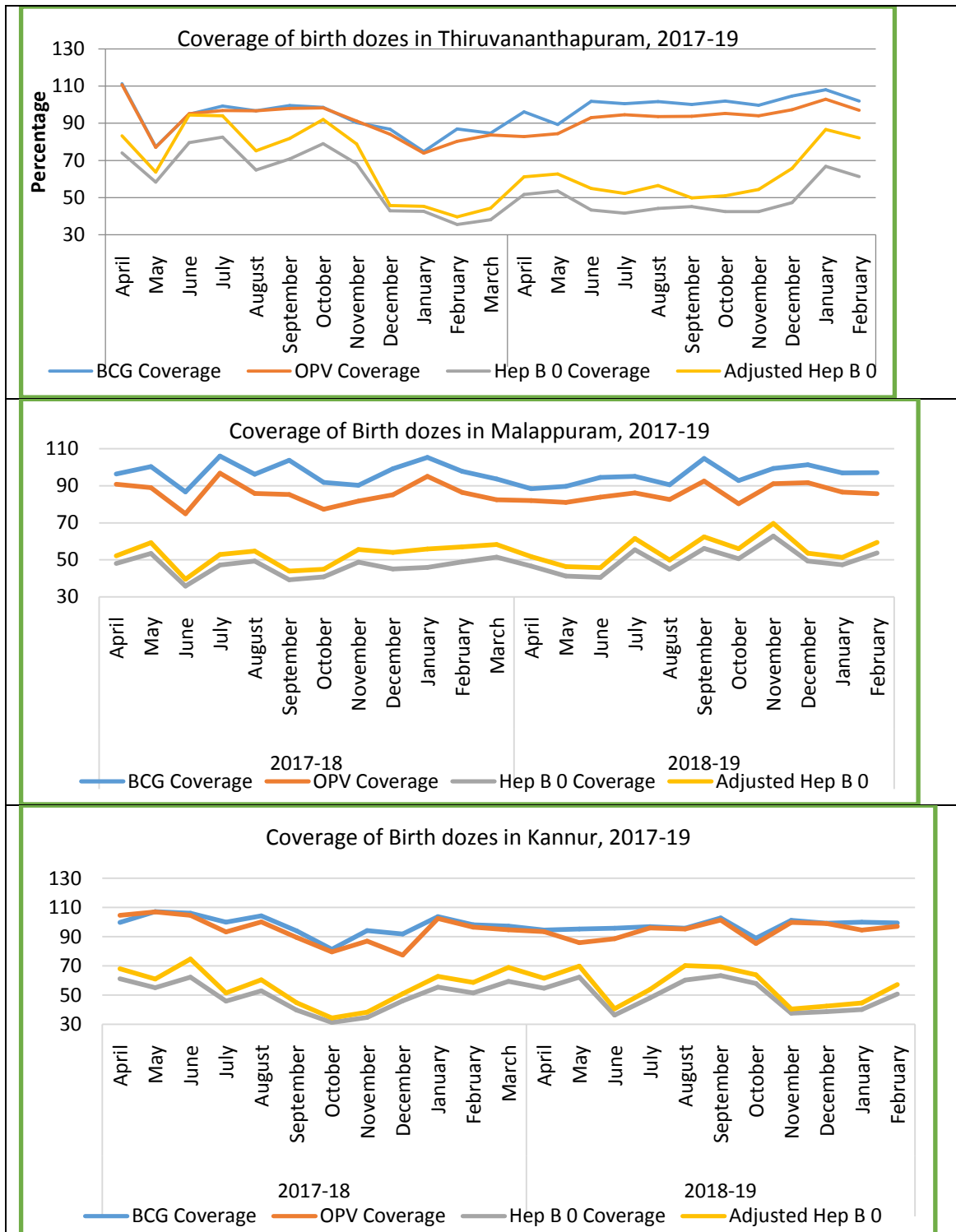


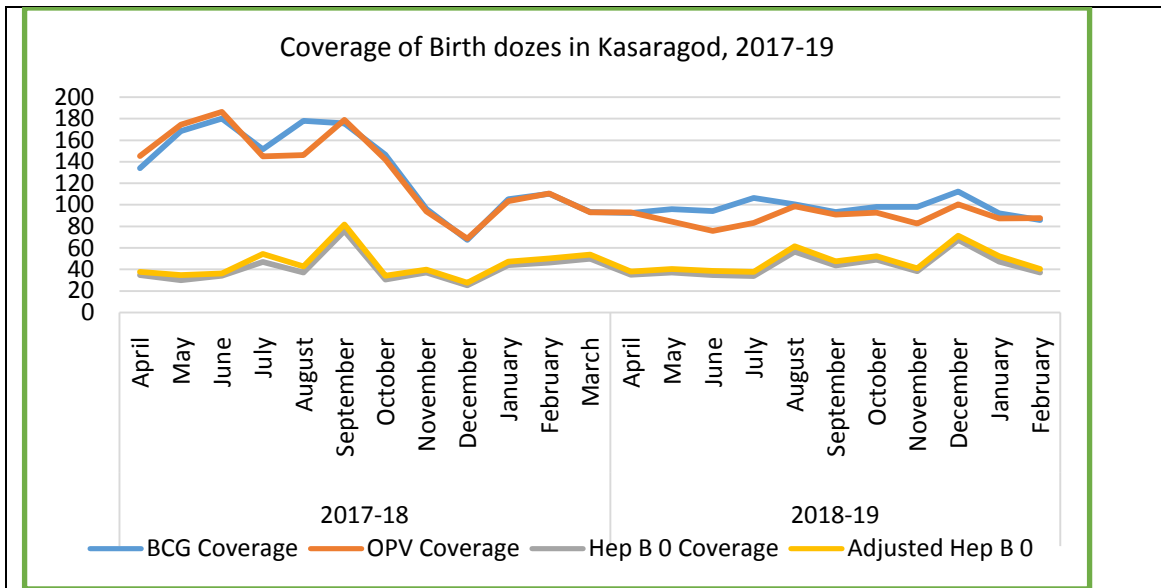
The districts like Alappuzha, Ernakulam, Palakkad, Thrissur, Kozhikode and Wayanad has grouped into one with medium coverage of birth doze of Hepatitis B during 2017-19. While going through the graph, one can assess the trend in these districts as ranging between 50 and 80 percent. The gap between Hepatitis B and other birth doses has remained almost same in the reference period. Except Kozhikode and Wayanad, the level of coverage of BCG and OPV has not shown higher values in other districts. In Kozhikode and Wayanad, during the initial months, BCG and OPV have even exceeded 130 percent.

The coverage of birth dose of Hepatitis B has always kept a gap of 20 points with the coverage of other two birth doses. While considering the adjusted Hepatitis B, it seems to be applicable in the district as it has partially covered the gap between other vaccines. Even the adjusted Hepatitis B also recorded 75 percent in 2017-18 and 72 percent in 2018-19. This lower coverage in the district points towards influence of possible other factors affecting the immunization coverage of Hepatitis B0. Over the period, coverage of Hepatitis B0 has increased in Ernakulam from a lower value of 38 percent in July 2017 to 86 percent in January 2019. The steady decline has been reported in the district throughout the reference period. At the same time the values have again declined in May, 2018 and February 2019 to 70 percentage. Such zigzag tendency needs to be explained. Thrissur and Palakkad had shown a similar trend during the period of reference. Coverage of Hepatitis B has not improved in Thrissur, but the values show a significant consistency. At the same time, over the period, the coverage of the same in Palakkad has increased from 63 percent to 67 percent. But the progress is not uniform throughout the months. Coverage was recorded about 50 percent in the initial months and then attained to 70 percent in the beginning of 2018-19, but sharply declined to 49 percent in September 2018. Such sudden changes need to be further analysed.

The northern two districts Kozhikode and Wayanad had shown an average coverage of about 74 percent during the period of reference. But the steep decline and high peaks in the graphs point towards more data inconsistencies. The coverage of Hepatitis B0 was recorded as low as 56 percent in Kozhikode during August, 2017 and then recorded 98.6 percent in October 2018. Except these outliers, the coverage has shown an increasing trend during the period. At the same time, Wayanad has recorded the coverage more than 100 percent during April, May 2017. The trend in 2017-18 was almost same, but in June 2018, the values have suddenly declined to 60 percent in Wayanad. Though the coverage ranged between 74 and 93 percent in Wayanad, the data inconsistencies need to be analysed in detail before attaining a conclusion about the status of coverage of Hepatitis B0.

Figure 5.5: Districts with lower coverage of Hepatitis B, 2017-19





The southernmost district Thiruvananthapuram and northern districts like Kasaragod, Kannur and high fertility district Malappuram comes under the category of lower coverage of Hepatitis B0 in the State. Though the pattern in these districts is not unique, based on the yearly coverage of the vaccine they have been included in a single group. There is a clear gap between other vaccines and Hepatitis B0 in Thiruvananthapuram over the period. The graph clearly shows this gap and it increases during initial months of 2018-19. Though there is no accurate reason for the decline in coverage of the vaccine, data inaccuracy and shortage of vaccine may be behind this poor coverage in the district. During July, 2017 the vaccine coverage was 82.5 percent and then declined to 35.6 percent in January, 2018. The coverage of other vaccines also experienced such a zigzag trend. In general, data quality of HMIS needs to be verified further for possible reasons for the trend in the capital city. Malappuram, Kasaragod and Kannur have a similar pattern in the coverage of Hepatitis B0. While the other basic vaccines have a coverage of more than 85 percentage, only the coverage of Hepatitis B0 is poor in these districts. During 2017-18, Malappuram has recorded highest coverage of 53 percent in May 2017 and lowest coverage of 35.7 percent in June, 2017. At the same time, the coverage of BCG and OPV remained above 85 percent in Malappuram. The district has recorded highest coverage of Hepatitis B0 in November 2018 (62.8 percent). As the share of delivery in the private clinics is more in the district, accuracy

of reporting to HMIS is needed to be verified. According to the Statistical wing of the district, deliveries in the private health facilities are properly reported and immunization coverage is also reported to the district. Hence, reasons need to be further explored for the continuous poor coverage of Hepatitis B0 in the district.

Kannur has recorded 31 percent of coverage in October 2017, which is further increased to 59 percent in March 2018. During 2018-19 also, the sudden decline in coverage is visible in several months, which will be effect of inaccurate data. Kasaragod district has recorded lowest coverage of 25 percent December 2017. During 2018-19, the percentage of coverage has not declined beyond 30 and has the highest score in December 2018. While checking with the adjusted Hepatitis B0 coverage in these districts, the graph clearly indicates no space for preterm and low birth weight babies there. This is more significant in Kasaragod, where both the lines flow together.

Data quality issues of HMIS may be the primary reason for the flawed reporting of Hepatitis B0 coverage in different districts during the period of analysis. The attempt of correction by adjusted Hepatitis B0 partially works in some districts (Palakkad, Thrissur and Ernakulam) and feebly joints in other districts (Kasaragod, Alappuzha, and Kottayam). The coverage of Hepatitis has not correlated with this. Further investigation is necessary before reaching any conclusion based on the HMIS data analysis. Though the system of HMIS data monitoring is strong as per records, it is not well used by the authorities. Cross checks must be periodically done to improve the quality of the data. Outliers like more than 100 percent coverage of Hepatitis point towards poor data monitoring (Wayanad, Idukki, and Kollam). The situation of number of newborn received Hepatitis B0 is more than the number of live births in particular months in these districts was remained unchecked.

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Likelihood of Gap in coverage of birth doze of Hepatitis B

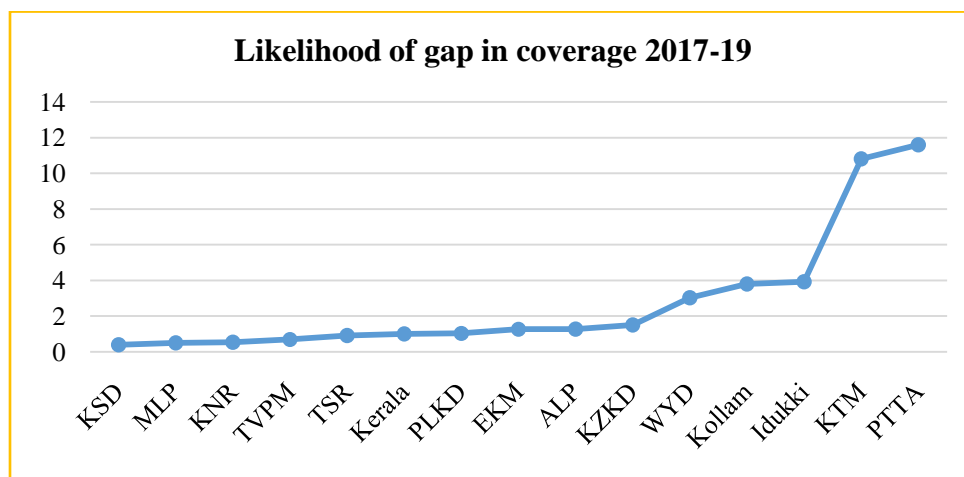
It provides an opportunity to compare the coverage of birth doze of Hepatitis B of each district with the coverage of the State. The statistical tool provides scientific information to assess the performance of each district. The average coverage of 2017-18 and 2018-19 has been used for assessing the likelihood of coverage among the districts in Kerala. The ratio has been calculated by dividing the average value of each district by

the (1-X) values. Likelihood of coverage has been estimated by dividing the ratio of each district by the values of the State (Kerala).

Table 5.4: Likelihood of gap in coverage of Hepatitis B0 among the districts in Kerala, 2017-19

Districts	Average	1-X	Ratio	Likelihood of Coverage
Kasaragod	41.98	58.02	0.723544	0.39
Malappuram	47.83	52.17	0.91681	0.5
Kannur	49.65	50.35	0.986097	0.53
Thiruvananthapuram	56.165	43.835	1.281282	0.69
Thrissur	62.69	37.31	1.680247	0.91
Kerala	64.9	35.1	1.849003	1
Palakkad	65.62	34.38	1.908668	1.03
Ernakulam	69.925	30.075	2.325021	1.26
Alappuzha	70.18	29.82	2.353454	1.27
Kozhikode	73.47	26.53	2.769318	1.5
Wayanad	84.82	15.18	5.587615	3.02
Kollam	87.55	12.45	7.032129	3.8
Idukki	87.885	12.115	7.25423	3.92
Kottayam	95.23	4.77	19.96436	10.8
Pathanamthitta	95.54	4.46	21.42152	11.59

Figure 5.6: Likelihood of gap in coverage of Hepatitis B0 in Kerala, 2017-19



The likelihood of gap in coverage of birth dose of Hepatitis B in Kerala is 11.2. The graph clearly shows that the likelihood of Pathanamthitta is 11.2 points higher than that of Kasaragod. The districts like Wayanad, Kollam, Idukki, Kottayam and Pathanamthitta have better coverage than the State level. At the same time districts like Kasaragod, Kannur, Malappuram and Thiruvananthapuram have less likelihood in

coverage of the vaccine. The other districts have more or less same likelihood of the State. Special focus need to be provided in improving the coverage of the vaccine in these districts apart from the State level initiatives. It also point towards data quality issues as the source of the study is HMIS.

Data quality issues of HMIS may be the primary reason for the flawed reporting of Hepatitis B0 coverage in different districts during the period of analysis. The attempt of correction by adjusted Hepatitis B0 with low birth and preterm neonates partially explains in some districts (Palakkad, Thrissur and Ernakulam) and poorly explains in other districts (Kasaragod, Alappuzha, and Kottayam). The coverage of Hepatitis B0 has not correlated with this. Further investigation is necessary before reaching any conclusion based on the HMIS data analysis. Though the system of HMIS data monitoring is strong as per records, it is not properly used by the authorities. Cross checks must be periodically done to improve the quality of the data. Outliers like more than 100 percent coverage of Hepatitis B0 imply poor data monitoring (Wayanad, Idukki, and Kollam). The situation of number of newborn received Hepatitis B0 more than the number of live births in particular months in these districts was remained unchecked.

5.2 Knowledge about transmission of Hepatitis B among health care providers

Operational Guidelines for Hepatitis B Vaccine Introduction in the Universal Immunization Programme by MoHFW, Govt. of India (2011) provides the details about HBV, the mode of its transmission, about the chronic and acute Hepatitis B infection, diagnosis of disease, about Hepatitis B vaccine, vaccine schedule, target groups, correct dosage, long term protection and booster dose and vaccination sites. It also gives information on storage temperature, freezing point of vaccine, safety of Hepatitis vaccine like, its mild transient side effects, serious allergic reactions, conditions which are contraindications and which are not contraindications, injection techniques and safety, dos and don'ts of administering vaccine, about following safe injection and waste disposal, adverse events following immunization(AEFI) surveillance and management of AEFI. Limitations of Hepatitis B vaccination, estimation of beneficiaries, estimation of vaccine and syringe requirements, estimation of storage needs, management of vaccine in cold chain, effects of heating and freezing on vaccine potency, preventing vaccine freezing during storage in cold rooms and in ice lined refrigerators, prevention of freezing vaccine during transport, check heat damage – Vaccine Vial Monitor (VVM), check for cold damage (freezing), conducting shake test, strategies to decrease vaccine wastage are also provided in the guidelines. Information like update recording and reporting system, training approach, training tips, training content-broad areas, advocacy and social mobilization, dissemination strategy, supervision, monitoring and evaluation, information for health workers, role of health workers in the introduction of Hepatitis B vaccine, information for parents etc. are also available in the guidelines. The risk of serious adverse events associated with Hepatitis vaccine is very low (1 -2/ 1000,000). Transmission of Hepatitis B occurs from infected person through blood transfusion; needle pricks unprotected sexual intercourse, sharing of eating utensils and other barber shop and beauty salon equipment. To curb HBV infection, prevention programs must be implemented and the complete vaccination schedule must be followed. Knowledge regarding the Hepatitis B virus and transmission is needed to minimize vaccine coverage to neonates and knowledge regarding safety precautions and disposal minimize the acquired infections among health workers and other neonates. They should have the complete knowledge of transmission of Hepatitis

B infections, importance of vaccinations and practice the correct storage procedure and simple hygienic measures.

The objective of this section was to assess the Knowledge towards Hepatitis B and birth dose of Hepatitis B vaccine and its safe storage among staff nurses and JPHNs in major Govt. district hospitals and in some PHCs and CHCs and private hospitals in Kerala. But the transmission from child to child which is the most reported transmission in India is known to 20 health staff out of 46 interviewed. Most of the nurses are aware about immunization schedule, dose etc. Almost all health staff interviewed except one has the knowledge about the route of mother to child transmission. Transmission through injection and sexual contact is known to cent percent health staff. Knowledge about transmission of HBV through sharing razors and ear piercing is less among health staff. Out of 46, only 24 health staff has the knowledge about the transmission of HBV through sharing razors and 20 have the knowledge about the transmission of HBV through ear piercing or tattooing. When asked about how is mother to child transmission happens, 37 out of 46 staff reported that it is during delivery time and 9 staff have reported that transmission of HBV is through placenta at the time of pregnancy. Some of them are confused whether the transmission occurs at the time of delivery or pregnancy. Symptoms associated with Hepatitis B are known to everybody except one. Similarly, except one, all reported that HBV is more infectious than HIV. Majority of them know about HBV is active on surfaces like table top, razor blades for about one week. They are confused that the disease is fatal or not. Out of the total, 24 think that disease is fatal and 17 think that it is curable and others have no knowledge about it. Thirty nine out of total staff think that Hepatitis B causes liver cancer and the remaining staff has no knowledge about it. Only 14 staff have the knowledge that HBV vaccination is a protection to liver cancer. Dose of Hepatitis B0 and number of doses in one vial are correctly reported by almost all staff but a fewer number of staff have the knowledge about the correct incubation period of the HBV. Side effect of the vaccine is reported correctly by majority of staff. Only 18 staff have the awareness about correct contraindications and a less number (only 5) of staff have the knowledge about the condition which are 'not contraindications'. None of the staff have knowledge about the correct freezing point of Hepatitis B vaccine. One staff nurse reported that one dose of Hepatitis B0 contains 1.5ml and all others are aware that it is 0.5ml. Similarly when

asked about number of doses of Hepatitis B in one vial of vaccine, only one among the staff reported as 20 doses and all others correctly reported as 10 doses.

Table 5.2.1 Details of the awareness level of status of Hepatitis B among Health staff

Awareness level of Staff on Hepatitis B		
<i>Aspects known to all respondents</i>	<i>Aspects known to half of the respondents</i>	<i>Aspects known to very few respondents</i>
<ul style="list-style-type: none"> ➤ Route of transmission is from mother to child, ➤ Transmission from mother to child is during delivery time ➤ Symptoms associated with Hepatitis B like fever, loss of appetite, nausea, vomiting, jaundice etc ➤ Virus is active on surfaces like table top, razor blades for about one week. ➤ Hepatitis B causes liver cancer ➤ Side effect of Hepatitis B0 ➤ HBV is more infectious than HIV ➤ One dose of Hepatitis B0 contains 0.5ml ➤ Number of doses of Hepatitis B in one vial of vaccine 	<ul style="list-style-type: none"> ➤ Transmission from child to child ➤ Transmission of HBV through sharing razors and ear piercing ➤ Hepatitis B is curable or fatal ➤ Conditions that are Contraindications 	<ul style="list-style-type: none"> ➤ HBV vaccination is a protection to liver cancer ➤ About the incubation period 2 - 5 months ➤ Conditions that are not contraindications ➤ Freezing point of Hepatitis B vaccine is - 0.5

Table 5.2.1 provides the details of the awareness level of status of Hepatitis B among selected Health staff from the hospitals visited. From the above Table 5.2.1 we can observe that almost all the health staff are aware about the following aspects related to Hepatitis B like route of transmission from mother to child, transmission from mother to child during delivery time, symptoms associated with Hepatitis B like fever, loss of appetite, nausea, vomiting, jaundice etc, virus is active on surfaces like table top, razor blades for about one week, Hepatitis B causes liver cancer, side effect of Hepatitis B0, HBV is more infectious than HIV, one dose of Hepatitis B0 contains 0.5ml vaccine

and number of doses of Hepatitis B0 in one vial of vaccine. But in case of the following aspects like transmission of Hepatitis B from child to child, transmission of HBV through sharing razors and ear piercing/ tattooing, Hepatitis B is curable or fatal, conditions that are contraindications are known to half of the respondents and very few respondents are aware about the aspects of HBV vaccination is a protection to liver cancer, about the incubation period 2-5 months, conditions that are not contraindications and the freezing point of Hepatitis B0 vaccine is -0.5. The above mentioned aspects related to Hepatitis B are according to the Operational Guidelines by MoHFW (2011), Govt. of India. Some of the staff have misconception that the transmission of HBV from mother to child is through placenta at the time of pregnancy. Most of the staff nurses working in the labour room, immunization section and OT reported that they have not received any training or advice from the authority about the operational guidelines for Hepatitis B0 vaccination. They are also reported that the knowledge available with them was attained from the part of their course. The above observations lead to the need of proper training to the health staff about the Operational Guidelines by MoHFW. So proper trainings should be imparted to the staff nurses who are engaged in the routine work of immunization in the hospitals.

5.3 Practices followed regarding HepB0 in the selected Hospitals

Pediatricians from the Government and private hospitals in Kerala were interviewed to understand the practices followed regarding Hepatitis B0 vaccination in the corresponding health facilities. Major observations are as follows:

As per the 'Operational Guidelines for Hepatitis B Vaccine Introduction in the Universal Immunization Programme' by MoHFW (2011) strict instructions were laid that the conditions which are contraindications and which are not contraindications regarding the immunization of Hepatitis B birth dose have to be followed. Table 5.3.1 shows the conditions laid down in the operational guidelines and the status of hospitals which followed those conditions. Majority of the hospitals are not providing Hepatitis B0 vaccine to neonates within 24 hours, if the birth weight of the baby is less than 2 kg or 1.8 Kg, however, it is against the operational guidelines. Some hospitals are not

providing Hepatitis B0 vaccine to neonates within 24 hours who have temperature below 38.5 degree Celsius, prematurity, have infection with jaundice at birth, HIV, history of seizures, diseases of the heart /lungs/ liver or kidney, treatment with antibiotics, congenital abnormalities, neurological conditions or cerebral palsy. It is identified that some hospitals have the shortage of Hepatitis B0 vaccine in one or two months during the year 2018-19 as per record and some delivery points are reported the shortage of immunoglobulin or non-availability at the time of delivery, and hence could not provide Hepatitis B0 to babies within 24 hours of birth. Hence it is necessary to provide instructions to follow the operational guidelines regarding Hepatitis B0 vaccination that premature or low birth weight babies should give Hepatitis B0 vaccination. Government should provide instructions to initiate local purchase if there is any shortage of vaccine which may ensure full coverage of Hepatitis B0.

Table5.3.1.Ideal practices and practices followed in the selected hospital regarding Hepatitis B0

<i>Ideal Practices for providing Hepatitis B0 within 24 hours</i>	<i>Ideal practice followed by</i>	
	<i>Majority of Hospitals</i>	<i>Some hospitals</i>
<i>Conditions that are not contraindications</i>		
Temp below 38.5C	✓	✗
Prematurity	✓	✗
Low birth weight	✗	✓
Jaundice at birth	✓	✗
Infection with HIV	✓	✗
History of seizures	✓	✗
Diseases of the heart/ lungs	✓	✗
Diseases of Kidney/ liver	✓	✗
Treatment with antibiotics	✓	✗
Congenital abnormalities	✓	✗
Neurological conditions	✓	✗
Cerebral palsy	✓	✗
<i>Contraindications</i>		
Severe Asepsis	✗	✓
<i>Reasons for Not providing vaccine</i>		
Shortage of Hepatitis B0	✓	✗
Shortage of immunoglobulin	✓	✗
<i>Vaccine storage and Data reporting</i>		
Vaccine storage Properly	✓	✓
Proper data reporting	✓	✓
Other conditions	✓	✓
✓ <i>Ideal practices followed</i>	✗ <i>Ideal practices not followed</i>	

Generally all neonates are given Hepatitis B0 before shifting from labour room to ward and from operation theatre to ward in the hospitals visited. In majority of the hospitals, one vial of vaccine is being stored at the refrigerator in the labour room for ensuring the vaccine at night time delivery otherwise it is providing the JPHN from PP unit. Neonates admitted in SNCU and NICU with low birth weight are not given the birth dose in some hospital but in some hospitals, neonates who have been shifted to SNCU are also given the birth dose. Status of Hepatitis B0 is marked in the case sheets when referrals are made to other hospitals. Some hospitals are considering muscle mass for administering the vaccine.

5.4 Practices in Private Hospitals

Proper vaccine storage and distribution of Hepatitis B0 to the labour room, OT and SNCU/ NICU and they ensure that none is omitted from the vaccination. They are noted the status of vaccination in the case sheet in case of referral. Pediatricians reported they had not given Hepatitis B0 for babies weighing less than 2kg till one year before but now all are given the vaccine in one hospital. The other hospital is not providing the vaccine if baby weighing less than 1.8kg and for premature births. There is no uniform practice among private hospitals. Pediatricians suggested that they are not aware about new programmes and guidelines which Government is updating. So they demanded inclusion of private health care providers on all training programmes. New guidelines which are updating by Govt. of India should be intimated through email or social media to them also.

6 Summary and Conclusions

The reported coverage of birth dose of Hepatitis B in Kerala is about 65 percent for both 2017-18 and 2018-19. But a large level district wise variation also exist as per the data. If we classify the districts according to the coverage, three groups are formed with one group recorded high coverage (above 90

percent) districts namely Pathanamthitta, Kottayam, Wayanad, Idukki and Kollam in 2017-18 and in the last year Pathanamthitta and Kottayam have high coverage. Medium coverage group (above fifty percent to 90 percent) includes Thiruvananthapuram, Ernakulam, Palakkad, Thrissur and Kozhikode in 2017-18 but Kollam, Alappuzha, Idukki, Ernakulam, Thrissur, Palakkad Kozhikode and Wayanad in 2018-19. Lowest coverage group (less than 50 percent) includes Malappuram, Kannur and Kasaragod in 2017-18 and Thiruvananthapuram, Kasaragod, Malappuram and Kannur experienced lowest level of coverage in 2018-19. Graphical representation of coverage of birth doses in Kerala over the period of two years from April 2017 to February 2019 shows a zigzag nature throughout the period. Over the period of study, the percent of Hepatitis B0 in the State has not improved beyond 65 percent.

As per data of Hepatitis B0 reports, wide variation among districts we visited in some health facilities mainly district hospitals of six districts and checked the records of live births and Hepatitis B0 data. We could not find out any mistake because data is properly reported from PP unit to the HMIS portal but shortage of vaccine is reported in Kozhikode and Alappuzha in some months. But in Thiruvananthapuram where we visited three major delivery points of Government institutions and two private hospitals, are not reporting such shortages and data reporting is also properly documented. But HMIS analysis shows Thiruvananthapuram is one among the lowest coverage districts. Proper data monitoring from the supervising authorities is needed in order to minimize the errors and improve data quality. Otherwise what we achieve in the service will not reflect in the HMIS portal which is being seen by the Government of India authorities and policy makers. The qualitative analysis point towards need for measures to increase the knowledge level of health providers. Administering the vaccine differ even among the Pediatricians and Staff Nurses. Awareness about latest guidelines instructed by MoHFW need to be generally reached to all the Medical Officers irrespective of Government or private institutes. Vaccine shortage need to be reported in HMIS and to higher authorities and initiation of local purchase must be done to ensure proper stock in each delivery point.

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